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CHEMISTRY.—*Some physical constants of* d-*gluconic acid and several of its salts.*[1] ORVILLE E. MAY, SAMUEL M. WEISBERG AND HORACE T. HERRICK, Bureau of Chemistry and Soils. (Communicated by EDGAR T. WHERRY).

During an investigation of the action of fungi on solutions of dextrose it was found that an organism belonging to the *Penicillium luteum-purpurogenum* group was capable of oxidizing dextrose to *d*-gluconic acid in good yields.[2] With a proper concentration of dextrose and inorganic nutrient salts and at temperatures in the region of 25°C. yields of *d*-gluconic acid up to 65 per cent of the theoretical were consistently obtained.[3] Because of the possibility of this acid attaining commercial importance, it was thought advisable to investigate the properties of some of its salts. A review of the literature revealed a great deal of contradiction concerning the composition and physical properties of these compounds.[4]

Few solubility data are recorded, and the degrees of hydration and the specific rotations reported for the different salts vary widely. Accordingly, several representative salts of *d*-gluconic acid were prepared and carefully purified. They were analyzed for hydrogen and cation, and specific rotation and solubility were determined. The results of these experiments are recorded in the accompanying table.

The salts were prepared either by neutralizing the acid directly with the carbonate of the metal or by treating a hot solution of barium

[1] Received October 29, 1929.

[2] O. E. MAY, H. T. HERRICK, C. THOM, and M. B. CHURCH. Journ. Biol. Chem. 75: 417. 1927.

[3] H. T. HERRICK and O. E. MAY. Journ. Biol. Chem. 77: 185. 1928.

[4] For a brief summary see: *Chemie der Zuckerarten*, by E. O. VON LIPPMANN. 310–314. Braunschweig, 1904.

gluconate with the calculated amount of the sulfate of the metal. They were all recrystallized at least three times from water-ethanol solutions and were dried in a vacuum desiccator over calcium chloride, some at room temperature and the others at higher temperatures. The hydrogen determinations were made by combustion of the salts in the apparatus designed by Phillips and Hellbach.[5] The methods of analysis for the cations are given in the table.

In the determination of specific rotations three grams of the salt was dissolved in enough distilled water to make 100 ml. at 20°C. The anhydrous salts, with the exception of magnesium and zinc gluconates, were used in this measurement. A 2 dm. tube was employed, and the measurements were made in a sensitive saccharimeter. The specific rotations reported in the table are for light passed through a dichromate filter and therefore, strictly interpreted, are not referred to the D line of sodium. The formula employed in the calculations of the specific rotation from the saccharimeter reading was $(\alpha)^{20} = \frac{100\ (0.3465\ a)}{6}$, where a is the observed reading.

The solubility measurements were carried out by shaking an excess of the salt with distilled water for at least 24 hours in a carefully regulated thermostat at 25°C. The trihydrates of the magnesium and zinc salts were used for these measurements. Immediately after stopping the agitation of the containers in the thermostat, the solutions were rapidly filtered, and an accurate portion was taken for analysis by means of a calibrated pipette. Analysis was then made for the cation by the method indicated in the table. The results given in the table are the averages of at least two determinations.

When obtained by crystallization from water-ethanol solutions and dried in vacuum desiccator over calcium chloride at room temperature the salts included in the table became anhydrous, with the following exceptions:—barium gluconate, $Ba(C_6H_{11}O_7)\cdot H_2O$; magnesium gluconate, $Mg(C_6H_{11}O_7)_2\cdot 3H_2O$; nickel gluconate, $Ni(C_6H_{11}O_7)_2\cdot 3H_2O$; and zinc gluconate, $Zn(C_6H_{11}O_7)_2\cdot 3H_2O$. The barium salt obtained from water-ethanol solution by crystallization and air drying between dry filter papers for two hours lost 9.24 per cent of its weight on being heated in the oven at 105°C. for two hours. The calculated loss for three molecules of water is 9.29 per cent. When allowed to stand in a constant temperature room at 25°C. the air dried salt slowly lost water

[5] M. PHILLIPS and R. HELLBACH. Journ. Assoc. Offic. Agric. Chem. 11: 393. 1928.

TABLE 1.—SOME PHYSICAL CONSTANTS OF THE SALTS OF GLUCONIC ACID

Salt	Analysis		Parts by weight in 100 ml. of solution at 25°C.	$(\alpha)^{20°}_{D}$	Methods of analysis
	Theoretical	Actual			
Sodium gluconate $NaC_6H_{11}O_7$	5.08% H 10.54% Na	5.00% H 10.44% 10.42% } Na	46.1 46.1	10.3	Na determined as sodium sulfate
Potassium gluconate $KC_6H_{11}O_7$	4.80% H 16.69% K	4.74% H 16.63% 16.65% } K	50.7 51.0	10.3	K determined as potassium sulfate
Ammonium gluconate $NH_4C_6H_{11}O_7$	7.23% H 6.57% N	7.08% H 6.48% 6.48% } N	30.0 29.8	11.8	N determined by Kjeldahl-Gunning-Arnold method
Barium gluconate $Ba(C_6H_{11}O_7)_2 \cdot H_2O$	4.44% H 25.20% Ba	4.46% H 25.33% 25.30% } Ba	8.7 8.7	9.0	Ba determined as the sulfate
Calcium gluconate $Ca(C_6H_{11}O_7)_2$	5.15% H 9.31% Ca	5.21% H 9.25% 9.23% } Ca	3.9 3.8	9.8	Ca determined as calcium oxide
Magnesium gluconate $Mg(C_6H_{11}O_7)_2 \cdot 3H_2O$	5.19% Mg	5.17% 5.13% } Mg	7.8 7.8	9.9	Mg determined as the pyrophosphate
Nickel gluconate $Ni(C_6H_{11}O_7)_2$	4.83% H 13.08% Ni	4.81% H 12.97% 12.92% } Ni	9.6 9.7	−0.5	Ni determined as the glyoxime compound
Manganese gluconate $Mn(C_6H_{11}O_7)_2$	4.98% H 12.34% Mn	4.77% H 12.32% 12.29% } Mn	16.8 16.8	10.1	Mn determined as the pyrophosphate
Zinc gluconate $Zn(C_6H_{11}O_7)_2 \cdot 3H_2O$	5.54% H 12.83% Zn	5.34% 5.34% } H 12.72% 12.82% } Zn	12.7 12.7	9.0	Zn determined as the pyrophosphate
Lead gluconate $Pb(C_6H_{11}O_7)_2$	3.71% H 34.70% Pb	3.64% H 34.61% 34.77% } Pb	5.1 5.1	−7.2	Pb determined as the chromate

of crystallization so that at the end of a week it contained 4.03 per cent water, indicating that in time it probably would completely give up two molecules of water. On heating the air dried salt in the oven at 65°C. for two hours a sample was obtained which contained 25.30 per cent barium. The theoretical content of barium for the salt containing one molecule of water is 25.20 per cent. The salt on being heated at 105°C. lost 2.95 per cent of its weight, whereas 3.30 per cent is the theoretical loss for one molecule of water. These results agree with those of Herzfeld,[6] and the conclusions are that the freshly crystallized salt is a trihydrate which slowly goes over to the monohydrate on standing, the speed of the transformation depending on the temperature and humidity.

When the magnesium salt is dried in a desiccator over calcium chloride it apparently contains three molecules of water to which it clings tenaciously. On analysis 5.17 per cent and 5.13 per cent Mg was found, calculated for $Mg(C_6H_{11}O_7)_2 \cdot 3H_2O$, 5.19 per cent. When dried to incipient decomposition at 105°C. it was found to contain 5.24 per cent of the metal, indicating that little or no water had been lost. These results are similar to those reported by Stoll,[7] who found that little water was lost on heating this salt at 98°C. under low pressures. The hydrogen determinations on this compound were unsatisfactory for some reason not fully apparent. Repeated determinations on two different samples of this salt gave average values of 5.46 per cent and 5.48 per cent of hydrogen; calculated for $Mg(C_6H_{11}O_7)_2 \cdot 3H_2O$, 6.02 per cent. The hydrogen determinations on the other salts were in excellent agreement with theory in most cases, as will be noted in the table.

The nickel gluconate when dried in the desiccator in the usual manner contained three molecules of water of crystallization. Found 11.45 per cent and 11.47 per cent nickel; calculated for $Ni(C_6H_{11}O_7)_2 \cdot 3H_2O$, 11.67 per cent. After drying for two hours at 105°C. this salt still retained some water of crystallization. At a temperature of 90°C., however, and a pressure of 20 mm. of mercury, it became completely anhydrous. Found, 12.97 per cent and 12.92 per cent nickel; calculated for $Ni(C_6H_{11}O_7)_2$, 13.08 per cent.

The zinc salt also contains three molecules of water when dried in a desiccator over calcium chloride. Found, 12.72 per cent and 12.82 per cent zinc; calculated for $Zn(C_6H_{11}O_7)_2 \cdot 3H_2O$, 12.83 per cent. This

[6] HERZFELD. Ann. Chem. **220**: 344. 1893.
[7] A. STOLL. U. S. Patent 1,648,368. 1927.

compound was unstable when heated, turning a dark brown color at 90°C., and was not obtained in the anhydrous condition.

The degree of solubility of the salts in water increases rapidly with rise in temperature, all being extremely soluble in hot water. The gluconates investigated formed supersaturated solutions very readily and some were maintained in that condition for several weeks.

The pronounced levo-rotation of lead gluconate and the feeble optical activity of the nickel salt were quite unexpected and no rational explanation for their behavior has been worked out. Each determination was repeated several times, using carefully purified materials. Furthermore, sodium gluconate solutions, freshly made from the levo-lead gluconate, always gave optical rotations corresponding to the usual values for the sodium salt.

Attempts to prepare crystalline *d*-gluconic acid following the procedure outlined by Rehorst[8] were not entirely successful In most cases the product obtained was contaminated with varying quantities of lactone and in no case was the yield as high as was expected. A small amount of the crystalline material was isolated, however, and the following determination of its specific rotation was made within 5 minutes after the acid was dissolved. C = 0.5 $(\alpha)_D^{20} = -2.5°$. After 30 min., $(\alpha)_D^{20} = +7.3°$.

The dissociation constant of the free acid was calculated from potentiometric measurements of the pH of freshly prepared .08 N and .0004 N acid solutions. The number of determinations was limited by the small amount of crystalline material available. The following equations were utilized:

$$pH = \log \frac{1}{(H)} \cdot \frac{(H) \times (C_6H_{11}O_7)}{(C_6H_{12}O_7)} = K.$$

The .08 N solution of the acid had a pH of 2.40, whence:

$$(H) = .004, \text{ and } K = (.004)^2/.076 = 2.1 \times 10^{-4}$$

The .0004 N solution of the acid had a pH of 3.78, whence:

$$(H) = .000166, \text{ and } K = \frac{(.000166)^2}{.000234} = 1.2 \times 10^{-4}$$

An average of these two values gives $K = 1.65 \times 10^{-4}$ which is comparable to the primary dissociation constants of malic and citric acids.

Summary.—Ten representative salts of *d*-gluconic acid were prepared and purified. The analysis, degree of solubility in water at 25°C., specific rotation, and degree of hydration of these salts are tabulated. The specific rotation and dissociation constant of *d*-gluconic acid are reported.

[8] K. REHORST. Ber. deutsch. Chem. Ges. **61**: 163. 1928.

ZOOLOGY.—*Field notes and locality records on a collection of amphibians and reptiles chiefly from the western half of the United States.* II. *Reptiles.*[1] CHARLES E. BURT AND MAY DANHEIM BURT, American Museum of Natural History. (Communicated by LEONHARD STEJNEGER.)

LIZARDS

Dipsosaurus dorsalis dorsalis (Baird and Girard).—A relatively small individual was found near a railroad track in a flat, hot, barren, sandy strip of desert wasteland 1 mile south of Red Rock, Pinal County, Arizona. When disturbed the animal moved from the cover of one desert bush to another with lightning like rapidity and it was shot only after an extended pursuit.

On the right bank of the Colorado River, in Imperial County, California, and just across from Yuma, Arizona, these lizards were particularly abundant. Here the river supports considerable vegetation in spite of its very fine, sandy soil and its proximity to the great sand dunes of the region. Just after we had crossed the interstate bridge we noticed some large brush heaps and a number of fallen trees by the roadside. Upon investigation we found that nearly every log or brush pile sheltered one or more of these keel-backed lizards. Although startled ones usually took shelter in some convenient hole, ten specimens (including some large adults) were collected here in a short time. Many escaped since attempts to dig individuals from their underground retreats failed in every instance but one.

Crotaphytus collaris (Say).—In KANSAS, many collared lizards were seen as they were quietly sunning themselves on the rocks of a large limestone quarry about noon on July 9, near Little Bear Mound at Neodesha, Wilson County. In OKLAHOMA, an adult male was found scampering over the flat rocks which were lying along the banks of a thinly wooded upland wash 8 miles south of Calvin, Hughes County. It ran a short distance on its hind feet. In TEXAS, 2 miles east of Rochelle, McCulloch County, a large male was found on a rocky ledge in a semi-arid section. A rocky, mountainous area proved to be the ARIZONA habitat of a collared lizard which was very inactive when discovered under a flat rock at 6:30 A.M. on July 20, at a point 14 miles south of Tombstone, Cochise County.

[1] Received October 3, 1929. The first instalment of the article appeared in THIS JOURNAL 19: 428–434. 1929.

Crotaphytus wislizenii Baird and Girard.—A single leopard lizard was taken from a low tract of sandy ground in the Valley of the Rio Grande, 1 mile northwest of El Paso, El Paso County, Texas, where there were many large clumps of mesquite.

Callisaurus ventralis ventralis (Hallowell).—These lizards were taken at various places in southern Arizona in desert areas of much loose sand and sparse vegetation. The relative openness of the habitat chosen is apparently correlated with behavior since these creatures seem to prefer to run around, rather than into, the existing vegetation. They often run for surprisingly long distances when disturbed and it is because of the length, swiftness and directness of their movement, and the suddenness with which it ends, that one often loses sight of a much desired specimen. A clump of desert grass, a rock, or some brush usually serves as a protection for an individual that has ended its flight, since these, like most other desert reptiles, apparently possess an instinctive knowledge of the value of such objects for concealment. While being stalked an individual often raises its head as high as the length of its front legs will permit in order that it may better watch its supposed pursuer. This movement sometimes serves as the sole indication of the lizard's presence in the vicinity of a particular bush or rock and it may be stated here that this species is about the most inquisitive lizard that we have observed.

The sexual dimorphism of this form is very striking. In July at least, the female has smaller femoral pores and a general ventral coloration of spotless white, broken only by the dark sub-caudal and latero-ventral bars (which are much less black than in the male) and by a distinctive tinge of light yellow on the sides of the abdomen and at the base of the tail. The male, on the other hand, has enlarged femoral pores, distinctive deep black sub-caudal and latero-ventral bars, and a slaty gular region. A patch of bright blue or green surrounds the latero-ventral bars and much orange is present behind the forearms. The base of the tail is usually colored as in the female.

Specimens have been taken 2 miles northwest of Casa Grande, 1 mile northwest of Casa Grande, 6 miles southeast of Maricopa, and 5 miles southeast of Maricopa, in Pinal County, Arizona; 10 miles east of Yuma, Yuma County, Arizona; and on the right bank of the Colorado River, just across from Yuma, Arizona, in Imperial County, California.

Holbrookia maculata approximans (Baird).—The habitat of certain of these swifts at Cambray, Luna County, New Mexico, proved to be a

level desert plain on the loose, sandy, and yet somewhat loamy soil where there were clumps of grass, numerous burning-bushes and an occasional large yucca plant, but no mesquite trees or clusters. Three adult males, collected here, all agree in the possession of a dark brown to grayish ground color which makes the characteristic dorsal dark spots very distinct. A female was light brown in color and the characteristic dorsal dark spots were partly absent and partly very faint. Also, the numerous, small, white spots which cover the back and sides of this subspecies were very much more poorly defined in the female.

In Arizona, 8 miles north of Bernardina, Cochise County, a flat, isolated, grassy area, about 20 feet long and about a fourth as wide, in which two individuals, a male and a female, were found, also sheltered specimens of *Cnemidophorus sexlineatus perplexus* and *Phrynosoma cornutum*. The semi-sandy soil was very reddish and many small rocks were present. As to the lizards, it is interesting to note that the male was dark gray as were the males taken in New Mexico, and that the female was brown or reddish like the female from New Mexico. However, the soil here in Arizona was more reddish, and a comparison of the two females shows that the Arizonan female has much more red in the coloration. In the face of this seemingly definite influence of the environment upon the coloration of the females (a case paralleled by the unsexed examples of *Phrynosoma cornutum* from the two localities), one cannot but wonder why it does not apply to the males as well! The superficial differences between the two sexes of *Holbrookia maculata approximans* are, at least at first sight, greater than that between its female and the female of the ordinary *Holbrookia maculata maculata* from northeastern areas.

Holbrookia texana (Troschel).—A representative of this species was captured at the base of a small mountain 1 mile west of Barillo Camp, or 15 miles east of Balmorhea, Reeves County, in the semi-desert country of western Texas. It was associated here with numerous specimens of *Cnemidophorus sexlineatus perplexus* and *Cnemidophorus tessellatus tessellatus*.

Uma notata Baird.—A single specimen of this distinct and well marked species was found 9 miles east of Yuma, Yuma County, Arizona, in an area characterized by much loose sand and a scattering of bunch grass vegetation. Its field behavior was so similar to that of *Callisaurus ventralis ventralis* that until collected it was presumed to be that form. Both of these lizards occur here in the same habitat.

Sceloporus clarkii Baird and Girard.—One of these spiny swifts was

found under a flat rock in a mountain ledge 14 miles south of Tombstone, Cochise County, Arizona, at 6:30 A.M. on July 20. It was inactive when taken.

Sceloporus elongatus Stejneger.—This was a very abundant species in Uintah County, Utah, where it was found about the extensive rock formations there. Many individuals escaped by hiding in crevices between the stones of their habitat, and usually more were collected where there was some vegetation, as above a stream, than elsewhere. Specimens were taken 4 miles east of Fort Duchesne, 5 miles south of Vernal, 8 miles south of Vernal, and 15 miles southeast of Jensen near the Colorado line.

Sceloporus graciosus graciosus (Baird and Girard).—Representatives of this form were common in Uintah County, Utah, where they were only less abundant than *Sceloporus elongatus* of the same general habitat. *Sceloporus graciosus graciosus* sometimes takes to the bushes as a means of escape, but will also hide in crevices as does *Sceloporus elongatus*. Specimens were obtained 6 miles east of Ft. Duchesne, and 15 miles southeast of Jensen near the Colorado line.

Sceloporus magister Hallowell.—An adult from 15 miles west of Las Cruces, Dona Ana County, New Mexico, occupied a habitat of fine, light brown sand and sought shelter in a mesquite clump.

A second individual was found in an area of sand and sage brush at Hazen, Churchill County, Nevada.

Sceloporus occidentalis occidentalis (Baird and Girard).—These Californian lizards were very abundant in rocky situations, especially in the vicinity of a water supply, such as a mountain spring, although they were by no means wholly confined to such places. One specimen was collected in a city garden where it took refuge under a rock. Specimens when pursued will go into any available crevice, lodging under rocks, culverts, cracks in the earth, leaves, or pieces of wood or tin. We chased one individual up a tree and another into a long tin pipe. These swifts scale rough vertical surfaces with ease and often attempt to escape detection by placing an object, such as the corner of a rock, between themselves and the observer.

Specimens were obtained by Mr. W. H. Burt in Strawberry Canyon, Alameda County; and by ourselves on the Mt. Diablo toll road, Contra Costa County; 11 miles west of Placerville, and 14 miles southeast of Placerville, Eldorado County; 6 miles west of San Rafael, Ross Valley (3 miles northwest of San Rafael), and top of the east peak of Mt. Tamalpais (about 4 miles southwest of San Rafael), Marin County;

above Lake Merced, near Ingleside, San Francisco County; and 2 miles west of Newberry Park, Ventura County.

Sceloporus occidentalis bi-seriatus (Hallowell).—We found this subspecies in brush piles and along rock ledges in San Diego County, California. Specimens were taken at Chollas Heights near San Diego, and 7 miles south of Escondido.

Sceloporus orcutti Stejneger.—One of these crafty lizards was secured from a large rock about 15 feet high 7 miles south of Escondido, San Diego County, California. Many others were observed but all of these found security in deep crevices in the rocks.

Sceloporus undulatus thayerii (Baird and Girard).—A specimen taken at Cambray, Luna County, New Mexico, was found in a sandy, semi-desert area where it took refuge under a yucca plant.

Uta graciosa (Hallowell).—An excellent series of these interesting little tree lizards was taken in Arizona. The usual mode of life is arboreal and only one individual was observed on the ground. While many were seen on the branches of living mesquite trees, only one was found on the branches of a dead tree and it escaped by running into a knothole. Upon being disturbed *Uta graciosa* stretches out at full length and thus flattens its body against the bark of the tree in which it is found so as to escape detection. The dorsal gound color of the lizard usually resembles the color of the bark very closely and on several occasions a specimen in plain sight escaped our attention for some moments.

A marked sexual dimorphism exists, in July at least, and this is much more evident in living specimens than in preserved ones. The living male has much more brilliant blue on the sides of the belly while the female is dull colored. The throat of both sexes is often beautifully tinted with yellow in life, that of the male usually being deeper in shade. The males also have much larger femoral pores than the females.

Specimens were obtained 10 miles southeast of Casa Grande, 2 miles northwest of Casa Grande, 6 miles southeast of Maricopa, 9 miles west of Maricopa, and 10 miles west of Maricopa, Pinal County; and 13 miles west of Maricopa, Maricopa County, Arizona.

Uta levis Stejneger.—This species, which has been called the "Rocky Mountain Tree Uta" by Van Denburgh, was taken by us as it scaled the enormous boulders by the side of the Victory Highway 15 miles southeast of Jensen, Uintah County, in western Utah. There were no trees in the vicinity.

The identity of this form seems somewhat in doubt, but since both Van Denburgh and Tanner have recently admitted it to Utah, our specimens are referred to it.

Uta stansburiana elegans (Yarrow).—This lizard, as we found it in western Texas, southern New Mexico and Arizona, is predominately a sand loving form, and in only one place out of the fifteen at which collections were made was it in a rocky habitat. Individuals are most often found near or within the radius of the great mesquite clumps which develop in the typical part of the range. They dart for nearby holes in the sand when frightened and usually find safety in the numerous tunnels among the roots of the mesquite plant.

In TEXAS, specimens were obtained at Plateau, Culberson County; and 2 miles east of Tornillo, and 1 mile northwest of El Paso, El Paso County. — In NEW MEXICO, 15 miles west of Las Cruces, Dona Ana County; 10 miles east of Deming, Luna County; and Steins, and 12 miles north of Rodeo, Grant County. — In ARIZONA, 5 miles northwest of Casa Grande, and 10 miles northwest of Casa Grande, Pinal County; and 11 miles east of Mohawk, and 7 miles east of Mohawk, Yuma County.

Uta stansburiana hesperis Richardson.—A small number of Utas from southern California are referred to this subspecies, apparently chiefly on geographical grounds. They were all taken from rocky areas, and usually from small boulders. Although most were collected in mountainous districts, several were seen or taken from isolated outcroppings of rock in pastures at much lower levels. In the daytime *Uta stansburiana hesperis* loves to bask in the sun as it perches on the uppermost extremity of a rock. Specimens were collected at Cottonwood, Lyon's Valley, and Bonsall, San Diego County; and 8 miles east of Newberry Park, and Big Tujunga Canyon (11 miles east of San Fernando), Los Angeles County.

Uta stansburiana stansburiana (Baird and Girard).—At Hazen, Churchill County, Nevada, a specimen was secured at 7:30 A.M. in a sandy area which was covered with sage brush. It was sunning itself on the eastern side of a bush.

In Utah, 6 miles east of Ft. Duchesne, Uintah County, examples were found on the ground near an outcropping of rocks. When disturbed several ran to the ledge and concealed themselves by hiding in the crevices between the boulders there.

Phrynosoma blainvilli frontale (Van Denburgh).—A little horned lizard, whose body measures only 30 millimeters in length and whose

tail is 9.8 millimeters long, was obtained among the summit rocks of the shrub-covered Mt. Diablo, Contra Costa County, California, on August 12. A larger example was taken by Mr. Oliver Millard on April 21, 1929, on the trail up Santa Lucia Mountain about 25 miles west of King City, Monterey County, California.

Phrynosoma cornutum (Harlan).—In TEXAS, a fine series of horned lizards was obtained along the roadsides, particularily in rocky and somewhat grassy places. Near Eden, a single individual was found in an extremely barren area near a rock quarry and at times examples were seen on the concrete pavement. Specimens were located 1 mile south of Kileen, Bell County; 2 miles east of Cove, and 1 mile southwest of Cove, Coryell County; and 8 miles south of Eden, Concho County. — In NEW MEXICO an example was found to be rather securely situated at the base of a clump of yucca plants at Cambray, Luna County. Here the spines of the yucca plant were much more formidable than those of the animal. — In ARIZONA, 8 miles north of Bernardina, Cochise County, an individual very closely resembled the red sandy soil upon which it was found.

Phrynosoma douglassii ornatissimum (Girard).—The habitat of one of these "short-horned" horned lizards was found to be the Nevada desert 2 miles north of Fernley, Lyon County, where the sand was coarse and loose and the vegetation was chiefly sage brush.

The occipital horns of this specimen point backwards and not upwards, and if one were to follow the latest keys, it would identify as *Phrynosoma douglassii hernandesi*. Although it seems rather absurd to retain these two forms as distinct from each other on this character alone, others may be found. Accordingly, this specimen is referred to *ornatissimum*, pending our revision of the genus *Phrynosoma*, especially since Van Denburgh, and Stejneger and Barbour, recognize only the latter form from the region.

Phrynosoma modestum Girard.—This distinct species was found living in the basin east of the Barillo Mountains in Reeves County, Texas. Specimens were secured at Barillo Camp (16 miles east of Balmorhea), and 2 miles west of Barillo Camp. Although there is relatively little grass in the region, numerous rocks and shrubs afford protection. One example was found by the roadside. It remained still as we approached, apparently relying solely upon its excellent concealing coloration to escape detection.

Phrynosoma solare Gray.—Between two tracts of sandy soil which were supporting an excellent growth of mesquite trees in southern

Arizona, 12 miles north of Nogales, Santa Cruz County, a specimen was found squatting in the road and relying solely upon its concealing coloration for protection. Another was seen running over an open, barren, sandy section in an auto camp at Tucson, Pima County. It was a male as shown by its large femoral pores and long tail.

Gerrhonotus coeruleus Wiegmann.—Several of these lizards were obtained by overturning the moderately dry mats of grass which were present about the shores of Lake Merced, near Ingleside, San Francisco County, California, at the time of our visit. Another common inhabitant of this same general area proved to be the garter snake, *Thamnophis ordinoides atratus*.

Gerrhonotus scincicauda scincicauda (Skilton).—Two individuals were taken among the dry leaves and grass which had collected in a woodland valley 7 miles west of San Rafael, Marin County, California. When caught they squirmed about a great deal and attempted to bite at every opportunity.

Two of these lizards have been sent to us by Mr. W. H. Burt. They are from Strawberry Canyon, near Berkeley, Alameda County, California, and from Foster's Ranch, Morgan Valley, Contra Costa County, California, respectively.

Leiolopisma laterale (Say).—One of these fine little skinks was captured after a faint rustle betrayed its presence within a heap of dried leaves beneath the oak trees which tower above the steep bank of the Verdigris River 4 miles northeast of Neodesha, Wilson County, Kansas.

Eumeces obsoletus (Baird and Girard).—Three large adults, secured from their secluded retreats beneath the flat rocks of a prairie ledge 6 miles east of Haddam, Washington County, Kansas, on June 26, were only moderately active since it had rained a short time before and the temperature was relatively low.

SNAKES

Lichanura roseofusca Cope.—Two specimens of this snake were removed from the road at Dulzura, San Diego County, California. The roadside area was one of brush and rocks.

Heterodon contortrix (Linnaeus).—This hog-nosed snake was obtained from a sandy area in the vicinity of the Little Salt Marsh, Stafford County, Kansas, and Mr. H. H. Schwardt has kindly given us an additional specimen from Argonia, Sumner County, Kansas.

Heterodon nasicus Baird and Girard.—At 8 A.M. on June 23 a medium-sized representative of this species was found lying on a sand bank 2 miles south of Ewing, Holt County, Nebraska, exposed to the full glare of the morning sun. It was dormant and inactive when taken and was easily lifted from the position where it had evidently spent the night. Two small specimens of *Bufo woodhousii*, which were collected near by, were carelessly placed into the collecting bag with the snake and later it was found that they had been devoured.

An example was found dead on the road 10 miles east of O'Neill, Holt County, Nebraska. It was open meadow land on each side of the road. Another specimen was collected in a pasture 4 miles north of Haddam, Washington County, Kansas, in an area of sand and rocks.

Coluber constrictor flaviventris (Say).—The blue-racer is a common snake of the middle west. In OKLAHOMA, it was found 4 miles north of Ochelata, Washington County, and in KANSAS, 3 miles east of Prairie View, Phillips County; and 6 miles east of Haddam, and just west of Washington, Washington County. A dead example was observed in the road 8 miles west of Mankato, Jewell County, Kansas.

Masticophis flagellum flavigularis (Hallowell).—A large example of this subspecies, kindly identified for us by Dr. A. I. Ortenburger, was obtained 2 miles south of San Angelo, Tom Green County, Texas, in a semi-arid area. It was first observed on the road but was finally captured at the top of a mesquite tree about seven feet above the ground.

Masticophis flagellum frenatus (Stejneger).—At 6:30 A.M. on July 22 a small racer of this form was found sunning itself on a sand mound at the base of a desert bush 6 miles southeast of Maricopa, Pinal County, Arizona. Another was obtained in the road 6 miles east of Jacumba, San Diego County, California, in a mountainous, rocky area.

Salvadora grahamiae hexalepis (Cope).—In an area of brush and shrubs one of these snakes was obtained at Indian Springs, San Diego County, California.

Pituophis catenifer catenifer (Blainville).—A specimen found dead on the road 4 miles southeast of Folsom, Sacramento County, California, is apparently intermediate between *Pituophis catenifer catenifer* and *Pituophis catenifer heermanni* both geographically and in coloration. The dorsal spots on the body are 52, and on the tail, 20.

Pituophis catenifer deserticola Stejneger.—This gopher snake was taken 3 miles east of Reno, Washoe County, Nevada, near irrigation

ditches and cultivated fields. Also, 10 miles northeast of Battle Mountain, Lander County, Nevada, near a swamp.

Pituophis catenifer rutilis Van Denburgh.—An adult was stretched out in front of a hole beneath a soapweed bush in the sandy desert 2 miles north of Rodeo, Grant County, New Mexico. When approached it attempted to escape into the hole.

Pituophis sayi (Schlegel).—Bull snakes are very common in the middle west, where they live chiefly in cultivated areas. In KANSAS, specimens were secured 1 mile southwest of Kensington, Smith County; near the Big Salt Marsh, Stafford County; at Belvue, Pottawatomie County; and 6 miles north of Haddam, 5 miles northeast of Haddam, and 2 miles northwest of Haddam, Washington County. — In SOUTH DAKOTA, a small specimen was found at the edge of the road on the right bank of the Missouri River near the Wheeler Bridge, a short distance from Wheeler, in Gregory County. — In COLORADO, a specimen was obtained 12 miles west of Denver, in Jefferson County.

Lampropeltis californiae californiae (Blainville).—Two of these king snakes were found in the road near grass patches at Chollas Heights, San Diego County, California.

Lampropeltis calligaster (Say).—Mr. Howard Shaffer has sent us a specimen of this species that he collected 6 miles north of Haddam, Washington County, Kansas. We observed a partly decayed example on the road 1 mile south of Clifton, Clay County, Kansas.

Lampropeltis triangulum syspila (Cope).—A single representative of this coral king snake was found at Courtland, Republic County, Kansas.

Natrix grahamii (Baird and Girard).—One of these water snakes was found under a stone near the Verdigris River, 4 miles northeast of Neodesha, Wilson County, Kansas.

Natrix sipedon sipedon (Linnaeus).—A large individual, shot near the edge of Nutch's Pond (2 miles east of Haddam), Washington County, Kansas, was found to contain a large transforming tadpole of *Rana catesbeiana*.

Natrix transversa (Hallowell).—An example of this form, taken between Caney, Kansas, and Owen, Oklahoma, 2 miles south of the state line, in Washington County, Oklahoma, was under a flat board near a pond. Another, secured along the Verdigris River, 4 miles northeast of Neodesha, Wilson County, Kansas, was under a flat stone.

Three individuals were found at a partly submerged stone pile near a bridge 2 miles northwest of Toyahvale, Reeves County, Texas.

Here a small stream of clear water flowed past and its pools were filled with fish and frogs and thus, no doubt, it provided food as well as a cover of aquatic vegetation.

Thamnophis megalops (Kennicott).—A specimen, secured 2 miles northwest of Toyahvale, Reeves County, Texas, was lying in the vegetation of a small, running stream with its body partly submerged, but another, 4 miles north of Crittenden, Santa Cruz County, Arizona, was near a shallow, stagnant, roadside pool above which were mesquite trees.

Thamnophis ordinoides ordinoides (Baird and Girard).—Mr. Teunis Vergeer has given us several specimens of this form that were collected by Mr. J. Vergeer at Portland, Multnomah County, Oregon.

Thamnophis ordinoides atratus (Kennicott).—We found this garter snake along the small Islais Creek, below Mission Bridge, in San Francisco, San Francisco County, California, where it was associated with large numbers of the frog, *Hyla regilla*. These snakes were particularly abundant at Lake Merced, near Ingleside ,in the same county, where they occurred in the grass and sedges at, and above, the edge of the water.

Thamnophis ordinoides elegans (Baird and Girard).—Two Californian representatives of this subspecies were found dead on the highway in the vicinity of running water. These were taken at the north end of the Antioch Bridge on the Victory Highway, in Solano County, and at Truckee, Nevada County, respectively.

Thamnophis ordinoides vagrans (Baird and Girard).—Near a clear mountain stream 4 miles east of Fort Duchesne, Uintah County, Utah, and by the side of a dirty roadside pool at Bear River, Routt County, Colorado, representatives of this form were collected. Others were taken in Routt County, 5 miles northwest of Steamboat Springs, and 10 miles south of Steamboat Springs, in the latter place by the side of mountain spring at the foot of Rabbit Ear Pass.

Thamnophis radix radix (Baird and Girard).—On April 30, 1927, a pair of these garter snakes were taken from a hole in the vicinity of the Little Salt Marsh, Stafford County, Kansas. They were entwined about each other and were probably carrying on mating activities, although actual copulation was not observed. Mr. H. H. Schwardt has given us a specimen from Silvia, Rice County, Kansas, and we took one 3 miles east of Rexford, in Thomas County.

In Colorado, one was found along a small stream 3 miles east of Denver, Denver County.

Thamnophis sauritus proximus (Say).—An adult was found under a rock in a prairie ledge above a permanent streamlet 6 miles east of Haddam, Washington County, Kansas. Another, secured at Mertzon, Irion County, Texas, was in a semi-marshy pool by the side of a slow-flowing creek.

Thamnophis sirtalis sirtalis (Linnaeus).—One of these snakes was found near a meadow 5 miles southeast of Dyersville, Dubuque County, Iowa.

Thamnophis sirtalis parietalis (Say).—All of our specimens of the red-sided garter snake were collected in Kansas. We found them at the edge of Nutch's Pond (2 miles east of Haddam), and on the bank of Mill Creek, just north of Morrowville, in Washington County. In the latter locality two young were secured on September 2, and these, we presume, were born but a short time before. An adult was crawling along the muddy bank of the Verdigris River, 4 miles northeast of Neodesha, Wilson County, on July 8.

Tantilla gracilis (Baird and Girard).—Two sand snakes were on a flat, elevated, grassy plain under rocks in the vicinity of Little Bear Mound at Neodesha, Wilson County, Kansas. They were in the dampest situations possible and specimens were not found under rocks that were completely dry beneath.

Crotalus confluentus confluentus (Say).—This rattlesnake was found near an open prairie, chiefly of buffalo grass, 3 miles southeast of Buick, Elbert County, Colorado. Another was taken in a similar habitat 9 miles west of Limon in the same county.

Crotalus exsul (Garman).—An adult of this form was found at Dulzura, San Diego County, California, resting on a pile of rocks in the shade of an irrigation wall.

Sistrurus catenatus catenatus (Rafinesque).—One of these rattlesnakes was located in a grassy pasture 5 miles northeast of Haddam, Washington County, Kansas.

Turtles

Chelydra serpentina (Linnaeus).—This species is ordinarily confined to the permanent ponds and streams, but after rains individuals may be found long distances from water. Thus, one of our specimens was taken near farm buildings and another on the main street of a town. Both were secured after a rain and both had traveled, no doubt, from the nearest streams.

In Kansas, specimens were found 6 miles east of Haddam, Washington County, and Mr. Richard E. Nelson has given us an example collected 2 miles south of Blue Rapids, Marshall County.

In addition we have specimens taken at Bristow, Boyd County, Nebraska, and one presented to us by Miss Bertha L. Danheim from La Salle, La Salle County, Illinois.

Pseudemys elegans (Wied).—A large example of this form was obtained on the bank of the Verdigris River 4 miles southeast of Neodesha, Wilson County, Kansas.

Terrapene ornata (Agassiz).—These land turtles are very common in the middle west, particularly in pastures where they find shelter in shallow holes or burrows. In NEBRASKA, specimens were collected 2 miles northeast of Bristow, Boyd County. — In KANSAS, 3 miles west of Lawrence, Douglas County; and 6 miles east of Haddam, and 6 miles north of Haddam, Washington County.—In OKLAHOMA, 7 miles north of Ochelata, Washington County.

Chrysemys bellii bellii (Gray).—In Nebraska, our specimens were obtained in the shallow, sand-bottomed Ponca Creek just south of Bristow, on the road just west of Bristow (after a rain), and in shallow ponds 5 miles north of Bristow, all in Boyd County. An example secured 2 miles east of Flagler, Kit Carson County, Colorado, was carried into Kansas and while there it escaped from us.

ZOOLOGY.—*A new species of* Centrolophus *from Monterey Bay, California.*[1] KENNETH L. HOBBS, Linden, Md. (Communicated by E. A. GOLDMAN.)

While collecting in the harbor of Monterey during early August, 1929, I found three specimens of Rudder Fish living commensally within the gastrovascular cavity of the large jelly-fish *Phacellophora ambigua* (Haeckel). This medusa was quite abundant in the harbor at the time, having collected in the coves and among the pilings of docks. Specimens of the parasitic amphipod *Hyperia medusarum* (Müller) were also found in the canals of the medusae containing the fish. This, I believe, is the first time that this genus of fish has been recorded from the coast of California. Other members of the genus being found in Australia, *C. maoricus* (Ogilby), and two in the North Atlantic, *C. brittanicus* (Gthr.) and *C. niger* (Gmelin), the latter also occuring in the Mediterranean.

[1] Received October 20, 1929.

Centrolophus californicus sp. nov.

D. 40–43 A. 28–30 P. 19 V. 1–5 Scales 120–11–1–22

Depth of body into length 3 times, length of head 3.2 times. Body elongate and compressed. Diameter of eye contained in length of head 3.65–3.75 times. Maxillary under preorbital for entire length but not hidden. Palatine teeth none. Maxillary teeth in a single series. Interorbital width into head length 2.8–3 times. Preoperculum without spines. Gill rakers elongate. Snout into head length 4.5.

Dorsal fin rays 40–43 increasing in length and becoming rounded posteriorly. Spines of the dorsal indistinct. Anal fin rays 28–30 with an outline similar to the dorsal and likewise rounded most posteriorly. Caudal fin slightly forked with rounded lobes. Pectoral 19, ovate. Ventral 1–5.

Scale count from the upper anterior opening of the gill chamber to the base of the caudal fin 120. 11 or 12 scales above the lateral line, 21 to 25 below.

Lateral line curved anteriorly becoming straight at a point midway between tip of snout and tip of caudal fin. Each scale in the lateral line pierced by a pore. Specimens, probably young, measuring 81–40 mm.

COLOR: Silvery gray above and pale below. Fins blackish to gray.

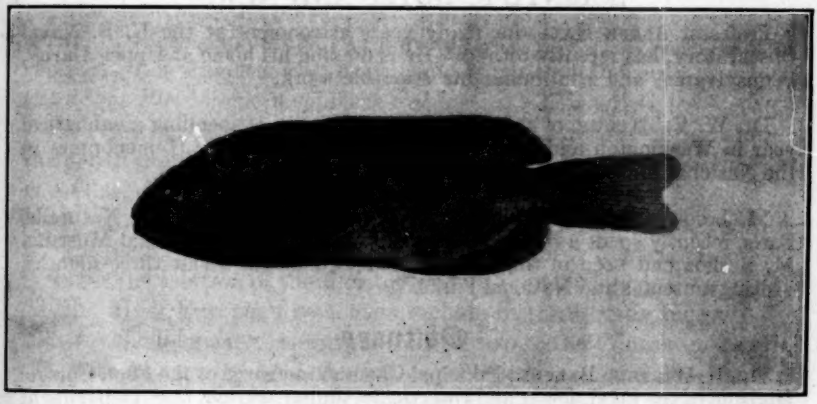

FIG. 1. *Centrolophus californicus* sp. nov.

REMARKS: Specimens removed from the medusa lived successfully for several days in a pint jar with running water. At the end of that time the larger animals developed cannibalistic tendencies toward the smaller individual. This feature seemed to show that the pint jar made a good substitute for the Scyphozoan. The body of the animals was extremely delicate and soft, necessitating extreme care in preserving them.

TYPE: In U. S. National Museum, Washington D. C. Cat No. 89398. Figure 1.

SUMMARY OF THE SPECIES OF CENTROLOPHUS

	brittanicus [a]	niger	maoricus	californicus
Depth of body in total length (standard)	4	4	4	3
Length of head in total length (standard)		4½–5	4½	3.2
Eye into head length		4–4¼	4.1	3¾
Interorbital into head length		3½		2.8–3
Dorsal fin rays	45	37–41	38	40–43
Anal fin rays	30	111–20–22	25	28–30
Caudal		forked	deep emarginate	forked
Scales		185–205		120
Length of specimens	520 mm.	480 mm.		80 mm.
Color		Brown	Brown	Gray

[a] *Centrolophus brittanicus* is known from only one stuffed specimen, so that accurate measurements are impossible.

SCIENTIFIC NOTES AND NEWS

Professor ASAPH HALL, for many years astronomer at the U. S. Naval Observatory, has recently retired. He is making his home at Upper Darby, Pennsylvania, and continuing his scientific work.

Dr. W. V. BALDUF, of the University of Illinois, is spending a sabbatical year in Washington and has made arrangements to study Hymenoptera in the National Museum during a considerable part of the time.

M. JACQUES BERLIOZ, ornithologist at the Museum d'Histoire Naturelle, Paris, recently spent a day in the Division of Birds, U. S. National Museum. M. Berlioz had been in this country and Canada for about three months, visiting museums and National Parks.

Obituary

DR. R. WILFRED BALCOM, Principal Chemist in charge of the Food Control Division of the Food, Drug, and Insecticide Administration, U. S. Department of Agriculture, and a member of the ACADEMY, died October 17, 1929. He was born in Nova Scotia in 1877, studied at the Massachusetts Institute of Technology and at German Universities, receiving the degree of Ph.D. from Heidelberg in 1905. He taught for several years at the Massachusetts Institute of Technology and the University of Michigan, and later entered the Bureau of Chemistry of the Department of Agriculture, being transferred, upon the creation of the Food, Drug, and Insecticide Administration, to the position he held at the time of his death. He specialized in problems of food analysis and food control.